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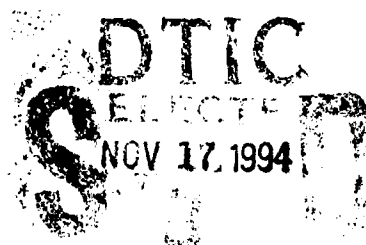


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Digital Mapping, Charting, and Geodesy Analysis Program Technical Review of Vector Smart Map (VMap) Level 1

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13. Abstract (Maximum 200 words). <p>The Naval Research Laboratory's Digital Mapping, Charting, and Geodesy Analysis Program (DMAP), in an effort to ensure that naval requirements are being met, has performed a technical review of the specification for Vector Smart Map (VMap) Level 1, as directed by the Defense Mapping Agency (DMA) via the Oceanographer of the Navy. VMap, a DMA product formatted in Vector Product Format, will eventually provide users with an excellent source of medium-resolution map data in digital form. Considering only the written specifications, DMAP discovered errors that could hinder not only the production of authentic VMap database libraries but also the user comprehension as well. DMAP emphasizes that essential changes should be made before prototype production begins. Minor suggested changes are also given.</p>			
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Digital Mapping, Charting, and Geodesy Analysis Program Technical Review of Vector Smart Map (VMap) Level 1

1.0 Introduction

Vector Smart Map (VMap) Level 1 is a digital mapping product currently under development by the Defense Mapping Agency (DMA) that is designed to support general Geographic Information System applications. Formatted in the Vector Product Format (VPF), VMap Level 1 is intended for standard DMA medium-scale products (1:250K). To date, several Joint Operational Graphicsmap sheets of Texas and Bolivia have been implemented into VMap databases. The Digital Mapping, Charting, and Geodesy Program, at the request of DMA via the Oceanographer of the Navy, has had the opportunity to review such prototypes and to suggest modifications (see, e.g., [1]). Once all suggestions have been considered, from this review as well as [1], the VMap product will provide users with an excellent source of medium resolution map data in digital form.

This particular evaluation of the VMap Level 1 specification [2] is based on two points of view: that of the analyst/user (comprehension) and that of Naval forces (requirements). Using this specification and its companion document on VPF [3], a user should be able to fully describe the structure of authentic VMap databases. The essential and suggested corrections to [2] listed in the following sections will lead to a quicker and more thorough comprehension of this specification. Appendix A of this review lists those Naval requirements not met by the VMap specification.

Since no implementation of a VMap database was included with the specification, this review is based solely on the written specification.

1.1 VMap Content

According to [2], VMap databases are allowed to consist of two kinds of libraries: data and reference. There is only one allowable reference library, RREFERENCE (note absence of "E" in spelling), while there may be several data libraries. Within RREFERENCE, there is one reference coverage, Library Reference, and three thematic coverages, Database Reference, Political Entities, and Place Names.

Within each data library, there exist 2 reference coverages and up to 10 thematic coverages:

A. Reference coverages.

- 1. Library Reference**
- 2. Tile Reference**

B. Thematic coverages.

1. Boundaries
2. Data Quality
3. Elevation
4. Hydrography
5. Industry
6. Physiography
7. Population
8. Transportation
9. Utilities
10. Vegetation

1.2 Accuracy Categories

The VMap Level 1 specification states that absolute horizontal accuracy is expressed in terms of ground distances measured in meters. Four classes of accuracy are defined on page 3 of the specification. Although these error limits may be acceptable, more specifics are required for Navy applications, i.e., which coverages and features are included in which accuracy categories. The associations between coverages/features and accuracy should be catalogued in the database either as data quality or in narrative tables. The same can be said for vertical accuracy.

1.3 VMap Features/Attributes and Naval Requirements

Thematic coverages are outlined extensively in Section 80.0 of the VMap Level 1 specification. Sample feature table headers are given and the legitimate VMap attribute and attribute values are provided. Moreover, Section 3.8 identifies fully the VMap feature and attribute coding scheme (DIGEST FACC).

A general question arises: Why were these particular features, attributes, and attribute values selected? Did they suit the geographic area of the current prototype under development? For example, GB005 Airport/Airfield in the AEROFACP.PFT has the attribute APT Airfield Type, which in turn has a selection of values 0, 1, 2, 4, 9, 11, and 999. Why was the value 5 (Glider Site), for example, not included?

Clearly, one alternative would be to simply include all values from the DIGEST FACC. Such a comprehensive inclusion would of course lead to larger value description tables, but at the same time reduce the length of the written specification. Also, certain updates (e.g., changing the written specification to add value 5 to APT, should this value be required) become obsolete. Whatever the solution, the issue of feature and attribute selection should be addressed. DMAP currently has not decided on one particular suggestion for this issue.

The table in Appendix A lists features and attributes, based on a Defense Modeling and Simulation Office survey [4], which are not met by the current VMap Level 1 specification. These features and attributes should be considered as suggested modifications.

2.0 List of Essential and Suggested Comments

The following list supplies comments divided into "essential" or "suggested." Page numbers and line/figure/table positions are given, as well as recommended alternate text. For the most part, these comments reference text through Section 80.1 (page 90) only, since the remaining sections are mostly table headers and specific coverage information.

Whenever many comments are needed to describe a figure or table, a copy of the figure or table is presented as a figure in this report (these figures are numbered consecutively). Since the VMap specification is so closely related in form to the VPF specification, references to specific locations in the VPF specification are also supplied.

KEY P = page L = line
T = table F = figure

2.1 Essential

- P 5 L 3 The phrase "at the VPF coverage level" appears to be used in different ways throughout the specification; here, it refers to the physical location "within a library" whereas in other text (P 16 L 4) it refers to the physical location "within a coverage." Standardize this phrase to mean the former; change other occurrences to, for example, "in a given coverage directory."
- P 6 L 41 Change SCC to HWT (SCC refers to an older example in predecessor of [3], namely MIL-STD-600006).
- P 7 L 27 Remove the word *structure* from "at the VPF coverage structure level."
- P 11 L 1 Since there is no (2), omit the label (1).
- P 12 L 19 This section (3.12.3.a) is more difficult to understand than corresponding text in the VPF standard [3], Section 5.4.2 and Appendix F. The problem stems from terms *node*, *cell*, *bin*, *index*, and *tree*. Specifically, the term *node* is used here to represent something completely different from a connected or entity node, which will undoubtedly cause confusion. One alternative is to use *bin* (or *cell*) for *node*, as in Appendix F of the VPF standard.

P 12 L 39 Change *nodes* to *bins*.

P 12 L 41 The section contains an incorrect term (*primitive* instead of *bin* or *cell*) and does not define the bin array record accurately. A suggested rewrite follows:

Bin array record. This record is a two-dimensional array, the length of which is the number of bins defined in the header record. The array contains an integer offset that points to the beginning of the bin data record and an integer primitive count for each bin.

P 12 L 46 The section is terse and confusing. A suggested rewrite follows:

Bin data record. This record structure contains one record for each primitive (the primitive count being defined in the header), each of which contain four 1-byte integers defining the primitive's minimum bounding rectangle and a long integer defining the primitive ID. These primitive IDs point into the associated primitive tables.

P 13 T 5 Make the adjustments to TABLE 5 that are given in Figure 1 of this review.

P 13 L 11 To clarify, add the phrase "among other things" following the word *specifies*. Also, can a primitive table be associated with a thematic index file? This statement claims that it can, although the VPF standard [3] does not list this type of index file as a possible file type for tile directories. If not, the corrected statement should read: "A fixed-length header of 60 bytes that specifies, among other things, the associated feature table and the column within that table being indexed." If so, then [3] needs an update.

P 14 L 1 Insert *of* after *one*: "... files have one of six ..."

P 14 T 6 The table defines the first integer in the header as the size of the header, whereas in the VPF standard [3], TABLE 6 defines the first integer in the header as the combined length of the header and the index directory. Either the VMap specification or the VPF specification should be changed. Moreover, the divider lines for this table do not partition the proper groups for a thematic index file. The corrections are included in Figure 2 of this review.

P 16 L 4 The phrase "at the coverage level" should be adjusted to read "within a coverage directory."

TABLE 5. Format for a spatial index (*.SI) file.

the correct form is *.SI

Starting Position (Bytes)	No. of Byte	Field Type	Description
0	4	Integer	Number of primitives
4	4	Float	Bounding rectangle x1
8	4	Float	Bounding rectangle y1
12	4	Float	Bounding rectangle x2
16	4	Float	Bounding rectangle y2
20	4	Integer	Number of nodes in index
HDR + n * 8	4	Integer	Offset of primitive list for node n
HDR + n * 8 + 4	4	Integer	Primitive count in integer units
HDR+BIN+OS+c*8 + 0	1	Byte	Primitive bounding rectangle x1
HDR+BIN+OS+c*8 + 1	1	Byte	Primitive bounding rectangle y1
HDR+BIN+OS+c*8 + 2	1	Byte	Primitive bounding rectangle x2
HDR+BIN+OS+c*8 + 3	1	Byte	Primitive bounding rectangle y2
HDR+BIN+OS+c*8 + 4	4	Integer	Primitive ID

Note: HDR is the length of the index file header record.

(24 bytes)

Indicate more clearly that these sections repeat.

The variable n ranges from 0 to the number of nodes-1

The variable c is (0... number of primitives for a node); the c value for the first primitive is 0.

BIN is the summed length of all the array records.

OS is the value for the offset variable in the corresponding bin array record.

b. Thematic index file. In the VMap Level 1 database, thematic

Figure 1. Modifications to TABLE 5.

used for the library attribute (extent) table..

TABLE 6. Format for thematic index (*.TI) file.

or #TI

Starting Position (Bytes)	No. of Byte	Field Type	Description
0	4	Integer	60 bytes is the size of this header.
4	4	Integer	Number of directory entries. This is the number of items being indexed by a particular index file.
8	4	Integer	Number of rows in the data table being indexed.
12	1	Char	Type of index file ('I' for inverted list index, or 'B' for bit array index).
13	1	Char	Type of data element being indexed: one of: I, T, S, or F.
14	4	Integer	Number of data elements comprising one directory entry (usually 1); except for a thematic index built on a text field.
18	1	Char	Type specifier for the data portion of the index file. Record IDs in inverted list index can be stored using either type 'S' (2-byte integer) or type 'I' (4-byte integer). Bit array index files always use type 'S'.
19	12	Char	Name of the VPF table being indexed with no path.
31	25	Char	Name of the column in the VPF table being indexed.
56	1	Char	Ordering flag ('s' indicating ascending order in the index directory)
57	3	Char	Unused.
$60+n*(d+8)$	d	Char Short float Integer Float Double Integer	The element being indexed (the code value from the attribute column of the table being indexed).
$60+n*(d+8)+d$	4	Integer	The byte offset from the beginning of the file where the row of IDs associated with this index entry is located.
$60+n*(d+8)+d+4$	4	Integer	The number of items within the row associated with this index entry.
$60+\text{number of index entries} * (d+8)$	-	-	Record IDs from the table being indexed.

Note: n ranges from 0 to number of index entries-1
d = size of (indexed type)

add this horizontal line

Figure 2. Modifications to TABLE 6.

- P 18 T 8 Referring to "table and file names" tends to lead one to believe that tables are different from files (this type of distinction is made in other TABLES and text within the VMap specification). Only "file names" should be used. Also, backslash (\) symbols are missing on directories VMAPLV1 and RREFERENCE. In footnote 1, insert the word *data* between *VMap* and *library*.
- P 18 F 4 In footnote 1, insert the word *data* between *VMap* and *library*.
- P 20 L 22 Add the word *only* after *contain* so that the reader will know RREFERENCE does not have a TILEREF coverage.
- P 21 L 21 Add *library* after *data*: ". . . files in the data library coverages . . ."
- P 23 F 7 Since thematic index file names are present in this figure, the "# footnote" (which reads "The pound is replaced with the prefix of the thematic index name which is based on the column name to which the index refers") should be added, which entails changing some of the * symbols to # symbols. In particular, those files with an extension of ATI or TTI need the change.
- P 23 T 11 TABLE 11 is not referenced in the text and probably should be referenced under 3.14.3.a. Also, FEATURE TABLES should not be listed in a table describing coverage "metadata."
- P 24 L 7 Related attribute tables have not been defined and are not defined in the VPF standard [3]. Either a brief description about these VMap-specific tables should be presented, or related attribute tables should be incorporated into [3].
- P 24 L 44 The phrase "All FCA and FITs" should be changed to "All FITs and the FCA" so that the reader knows that there is precisely one FCA per coverage.
- P 24 L 44 The phrase "At the coverage level" should be replaced with "within a given coverage directory."
- P 28 L 14 "At the coverage level" should be replaced with "within a given coverage directory."
- P 28 L 25 "At the coverage level" should be replaced with "within a given coverage directory."

P 28 L 28 This section presents the first text occurrence of the types of feature classes available in VMap (all other occurrences have been in figures and tables). Some confusion may result since these classes are not the classes defined in the VPF standard [3]. In particular, the node feature class is not distinguished from the point feature class in the VPF standard. Moreover, VPF [3] defines a complex feature class. There should be statements to compensate for the differences:

"There are no complex feature classes defined in VMap Level 1."

"Point feature classes and Node feature classes are normally considered as one type of feature class in VPF MIL-STD-2407."

P 33 L 16 Repeating an earlier technical question: Are thematic indexes used in conjunction with primitive tables (VPF [3] does not account for such files in the tile directories)? If not, the reference to thematic indexes should be deleted here. Otherwise, a reference to Section 3.12.3.b should be included.

P 36 T 23 In VPF [3] TABLE 17 p. 51 and TABLE 18 p. 52, the END and CND each have one column that is always null and is only included to maintain consistency between the two table types. In VMap, these null columns do not occur. The reason for this discrepancy should be given.

P 36 T 24 See previous comment.

P 38 L 8 According to VPF [3] TABLE 23 p. 55, the area feature table ID column is an optional feature pointer. The text in the VMap specification describes this column as "VPF required." This column may be required for VMap, but it is not required for VPF in general. Clarity is needed here.

P 42 F 9 The third partition of tile directories contains a tile directory that should be changed to a more appropriate letter: The first occurrence of /Q (in the highlighted column) should be /J, for example.

P 42 F 9 The partition descriptions should define the omitted letters in tiling (e.g., "First partition of 24 tile subdirectories lettered A to Z *omitting I/O*," etc.).

P 50 L 45 "Point, line, area, and text" should be changed to "node, edge, face, and text."

P 80 T 70 The caption is not correct: "VMap level data 1 coverages." A complete description would be "VMap level 1 data library thematic coverages."

P 83 L 19 ZD045 (Text Description) is not in DIGEST FACC.

2.2 Suggested

- P 5 L 3-5 Restate: "There are 2 reference coverages and 10 thematic coverages available for each data library (TABLE 1), and one reference coverage and three thematic coverages available for the reference library (TABLE 1)." This revised phrasing implies the fact that some coverages are optional.
- P 5 T 1 Differentiate the reference coverages from the thematic coverages in the second and third columns of this table. This separation can be accomplished by putting horizontal lines.
- P 5 T 1 DATAQUAL is the reserved name for data quality coverage, not DQ. A standard name should be used.
- P 10 T 2 Delimit the 3 fields (data type, number of elements, key type) as the "Column Format" referred to on p. 11.
- P 12 L 12 Change *Indices* to *Indexes*.
- P 12 L 16 Clarify what is meant by "tiled feature tables," since this statement is the first occurrence of tiling and tables together.
- P 12 L 52 Refer the reader to VPF [3] Appendix F after quoting the VMap bucket size.
- P 13 L 1 The reader should be made aware that thematic index files are optional.
- P 14 L 4 Metadata table thematic index (MTI) is not defined in VPF [3]. In particular, MTI is not defined as a reserved file extension on p. 49, t. 16. Stipulate that this suffix is VMap specific.
- P 16 L 15 Include heading for Section 3.13.2.
- P 16 L 21 Include heading for Section 3.13.3.
- P 20 L 4 Change "in each VMap library" to "in the VMap library where it resides."
- P 20 T 9 Indicate that TILEREF is only available in data libraries.
- P 21 L 20 Change "TABLE 10" to "TABLE 1" and delete TABLE 10 from the specification.

- P 21 L 21 FIGURE 8 should be moved closer to this reference (i.e., the first reference).
- P 21 T 10 TABLE 10 should be deleted since it is essentially TABLE 1. Refer the reader back to TABLE 1.
- P 22 F 6 The reference to *node* feature class names should be deleted in the "*" footnote" since the node feature class names are described in the "+" footnote."
- P 22 F 6 In the footnotes, substitute "represents" in place of "is replaced with" for a much clearer sentence.
- P 28 L 11 Sentences such as these, which curtail misunderstanding of the physical structure of VMap, should be more frequent.
- P 33 L 1 "Primitive Tables and . . ." should be "Primitive tables and . . ." for consistency among section headings.
- P 33 L 10 Sentences such as these, which curtail misunderstanding of the physical structure of VMap, should be more frequent.
- P 35 F 8 The caption for this figure should be more specific: "Primitive tables and associated files for data library reference coverages."
- P 37 L 22 After "winged-edge topology," a reference to VPF MIL-STD-2407 Appendix B should be included.
- P 62 T 41 A sample value for the STRING column, as was described in the text, would be more descriptive rather than "Text string." For example, TABLE 54 provides "Gulf of Mexico," "Fairfax," etc.
- P 63 L 3 In the first sentence, include *all* before the word *coverages*. In the second sentence, clarify the type of coverage: "For each *thematic* coverage . . ."
- P 64 T 44 The footnote states that LIBREF is described in Section 50.2.1.2, when actually LIBREF's feature tables are described in that section. Either this section number should be changed to 50.2.1, or the superscript 1 should be put on LIBREF.LFT and LIBREF.TFT.
- P 72 T 58 On previous TABLES, whenever each line represents a record value, a note was supplied to describe this presentation (e.g., TABLE 57). On this TABLE, the note is not included.

- P 79 T 68 A sample value for the STRING column, as was described in the text, would be more descriptive rather than "Text string." For example, TABLE 54 provides "Gulf of Mexico," "Fairfax," etc.

3.0 Editorial Comments

All editorial comments are included in the following list.

- P 27 L 4 Typo: "representedin" should be "represented in."
- P 33 L 4 Typo: "Figure" should be "FIGURE."
- P 41 L 1 Typo: "VMAP" should be "VMap."
- P 41 L 2 Typo: "VMAP" should be "VMap."
- P 41 L 4 Typo: "perlibrary" should be "per library."
- P 53 L 1 Typo: "10." should be "10.0." This is also true for 20., 30., etc.
- P 60 L 4 Although complicated, the correct title of Section 50.2 is "Reference library reference coverage tables and content" to be consistent with Section 60.0
REFERENCE LIBRARY THEMATIC COVERAGE TABLES AND
CONTENT.
- P 60 L 8 This section (Section 50.2.1) should be called simply "LIBREF coverage" to be parallel with "60.2 DBREF coverage," "60.3 POLBND coverage," and "60.4 PLACENAM coverage."
- P 62 L 1 Typo: "Library Reference Primitive tables" should be "Library Reference primitive tables."
- P 62 L 1 One of the following should be used, not a combination of both: "edge, connected node, and text" or "EDG, CND, and TXT."
- P 63 L 1 This title (Section 60.0) should read "REFERENCE LIBRARY THEMATIC COVERAGE TABLES AND CONTENT."
- P 78 L 5 One of the following should be used, not a combination of both: "edge, connected node, and text" or "EDG, CND, and TXT."

- P 80 L 1 For consistency, this title (Section 80.0) should read "VMap LEVEL 1 DATA LIBRARY THEMATIC COVERAGE DIRECTORY RECORD LAYOUT."
- P 236 L 2 Change Ak160 to AK160.
- P 236 L 11 Change Ah050 to AH050.
- P 330 L 1 The heading should read "TABLE of CONTENTS and INDEX."
- P 330 Appendix C of this review gives a more thorough outline that incorporates the editorial changes suggested in this review. For consistency, sections 3.3a, 3.3b, 3.5a, 3.5b, 3.13.1, 3.13.2, 3.13.3, 3.14.2.1, 3.14.2.2 should have titles.
- P 335 L 11 For consistency, this line should read "90.1 Description of coverages."
- P 335 L 12 For consistency, this line should read "90.2 Description of features."
- general note: Other VPF product specifications have appendices that are, in general, easier to read due to a more pleasing text font and layout. See, for example, the appendices of World Vector Shoreline and Digital Nautical Chart.

4.0 Recommendations

The "essential" comments noted above should be incorporated into the VMap Level 1 specification. These changes are necessary for compliance with the VPF specification and will promote VMap user comprehension.

Although of lesser importance, the "suggested" comments will nonetheless enhance the specification. In particular, the Naval feature/attribute and accuracy requirements, which are not met by VMap Level 1, should be investigated for inclusion.

Finally, the editorial changes listed in this review under Section 3.0 should be made.

5.0 Acknowledgments

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Technical review of this report was provided by Mr. Mike Harris and Ms. Maria Kalcic, both of the NRL Mapping, Charting, and Geodesy Branch, and Ms. Mary Clawson of the NRL Marine Geosciences Division.

6.0 References

1. Susan Carter, et al. "Technical Reviews of Vector Smart Map (VMap) Prototypes 1 and 2," Memorandum Report 7516, Naval Research Laboratory, Stennis Space Center, MS (in review).
2. Defense Mapping Agency, "Draft Military Specification Vector Smart Map (VMap) Level 1," MIL-V-89033, September 1993.
3. Defense Mapping Agency, "Draft Military Standard Vector Product Format," MIL-STD-2407, September 1993.
4. Kevin Shaw, et al. "An Analysis of Navy and Marine Corps Digital Mapping, Charting, and Geodesy Requirements for Modeling and Simulation," Formal Report 9435, Naval Research Laboratory, Stennis Space Center, MS (in review).

Appendix A. Suggested Feature and Attribute Additions to VMap Level 1 (based on a 1992 DMSO survey).

THEMATIC COVERAGE	FEATURE	ATTRIBUTE
Boundaries	none	Length, Width, Height above Ground, Surface Material, Orientation to North, Height Accuracy
Elevation	Regular Spaced Grid, Triangular Irregular Network, Irregular Network, Slope Polygon, Depression, Berm/Barricade, Ridge Line	Lineage
Hydrography	Sounding, Piling, Underwater Cable, Shipping Channel, Inland Channel, Current/Flow Arrow, Tunnel/Bridge, Spoil/Disposal Area, Gridiron, Offshore Loading Facility, Maritime Station, Buoy, Electric Beacon, Light/Lighthouse, Crib, Breaker, Anchorage Area, Pier, Wharf Area, Ship Repair Area/Dry Dock, Sluice Gate, Bottom Sample	Orientation to North, L Bank Delineation, R Bank Delineation, L Bank Slope, R Bank Slope, Subsurface Material, Velocity, Lineage
Industry	Wrecking/Scrap Yard, Catalytic Cracker, Feedlot/Stockyard/Holding Pen, Storage Bunker/Mound, Blast Furnace	Length, Roof Type, Surface Material, Orientation to North, Density of Roof cover, Density of Tree Cover, Entrance/Exit, Windows-specific, Windows-general, Interior Floor Plan, Address, Occupant, Industry
Physiography	Volcano	Orientation to North, Height Accuracy, Lineage
Population	Plaza/City Square, Tent Dwelling, Underground Dwelling, Trailer Park, Cemetery, Athletic Field, Campground/Campsite, Drive-in Theater, Fairgrounds, Golf Course, Swimming Pool, Zoo	Roof Type, Surface Material, Orientation to North, Density of Roof Cover, Entrance/Exit, Window-specific, Window-general, Interior Floor Plan, Address, Occupant, Height Accuracy, Lineage

THEMATIC COVERAGE	FEATURE	ATTRIBUTE
Transportation	Culvert, Ramp, Railroad Turntable, Distance Marker, Route Marker, Vehicle Storage/Vehicle Parking, Dragon (Tiger) Teeth, Apron/Hardstand, Overrun/Stopway, Anchorage, Dry Dock, Lighthouse	Bridge Load Class, Under-bridge Clearance, Slope, Orientation to North, Substructure Description (spans), Route Number, Lineage
Utilities	Water Treatment Plant, Substation/Transformer Yard, Station (communication), Utility Line (water/gas/sewer), solar panel	Length, Roof Type, Surface Material, Orientation to North, Density of Roof Cover, Density of Tree Cover, Entrance/Exit, Window-specific, Window-general, Interior Floor Plan, Address, Occupant, Composition of Tower, Number of Cables in Conduit, Height Accuracy, Lineage
Vegetation	Hedge Row, Nursery, Scrub/Brush, Bamboo/Cane, Hummock, Open/Meadow/Pasture	Length, Surface Material, Orientation to North, Subsurface Material, Deciduous, Evergreen, Mixed, Wet, Open, Shrub, Summer % Density, Winter % Density, Spacing, Average Stem Diameter, Height Accuracy, Lineage

Appendix B. Acronyms.

AEROFACP.PFT	Airport Point Feature Table
APT	Airfield Type
CND	Connected Node Primitive
DBREF	Database Reference
DIGEST	Digital Geographic Information Exchange Standard
DMAP	Digital Mapping, Charting, and Geodesy Analysis Program
DMSO	Defense Modeling and Simulation Office
EDG	Edge Primitive
END	Entity Node Primitive
FACC	Feature and Attribute Coding Catalog
FCA	Feature Class Attribute Table
FIT	Feature Index Table
HWT	House of Worship Type
LIBREF	Library Reference
MTI	Metadata Table Thematic Index
NRL	Naval Research Laboratory
PLACENAM	Place Names
POLBND	Political Entities
SCC	Spring/Well Characteristic Category
TXT	Text Primitive
VMap	Vector Smart Map
VPF	Vector Product Format

Appendix C. Outline of VMap Level 1 Specification [2].

1.0 SCOPE

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